

REMARKS

Claims 1-17 are active. Claims 1, 6, and 17 are amended for clarity. No new matter is added.

The present invention refers to a process for the only hydrodealkylation of hydrocarbon compositions comprising alkylaromatic compounds C8-13. For obtaining the “**hydrodealkylation alone**” that is the production of benzene (B), toluene (T) and ethane (E) without side reactions of isomerization, transalkylation, disproportioning, etc., (see present application at page 1, paragraph 0011), the present invention provides treating the hydrocarbon with hydrogen (see H₂ charge/charge molar ratio), at least in the presence of a zeolite ZSM-5, with a molar ratio Si/Al comprised between 5 and 35, modified with a metal such as Mo, Ni, Pd, etc at specified, temperature, pressure, etc. The claimed process represents, therefore, a selection of operative conditions, in particular the selection of the zeolite which allows to obtain an aimed result.

The rejection applied under 35 USC 103(a) citing Drake is respectfully traversed. Applicants recognize that the presumption of the rejection that parts of the Drake disclosure may be pieced together to arrive at the claimed method with assumptions as to optimization so it would have been obvious to try to combine these portions with a reasonable expectation of success. Applicants cannot agree with this analysis because that is not the law of obviousness and the conclusions underlying the rejection based on the teachings of Drake are not correct. As explained recently by the Court of Appeals for the Federal Circuit:

First, an invention would not have been obvious to try when the inventor would have had to try all possibilities in a field unreduced by direction of the prior art. When "what would have been 'obvious to try' would have been to vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no

direction as to which of many possible choices is likely to be successful" an invention would not have been obvious.

O'Farrell, 853 F.2d at 903. This is another way to express the KSR prong requiring the field of search to be among a "finite number of identified" solutions. 550 U.S. at 421; see also Procter & Gamble, 566 F.3d at 996; Kubin, 561 F.3d at 1359. It is also consistent with our interpretation that KSR requires the number of options to be "small or easily traversed." Ortho-McNeil Pharm., Inc. v. Mylan Labs., Inc., 520 F.3d 1358, 1364 (Fed. Cir. 2008).

Second, an invention is not obvious to try where vague prior art does not guide an inventor toward a particular solution. A finding of obviousness would not obtain where "what was 'obvious to try' was to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it." O'Farrell, 853 F.2d at 903. This expresses the same idea as the KSR requirement that the identified solutions be "predictable." 550 U.S. at 421; see also Procter & Gamble, 566 F.3d at 996-97; Kubin, 561 F.3d at 1359-60.

Bayer Schering Pharma AG v. Barr Laboratories, Inc. 2009 U.S. App. LEXIS 17372, 91 U.S.P.Q.2D (BNA) 1569 (Fed. Cir. 2009)

As stated by the present application, under the operating conditions and with the composition of the catalyst of the present invention, it has been surprisingly found that the hydrodealkylation reaction is not only quantitatively selective towards the formation of benzene and toluene, but that the benzene/toluene ratio is always distinctly favorable with respect to benzene. See also, pages 2-3 and the Examples, e.g., on pages 18-19 of the present specification.

Drake, to the contrary, provides general indications how to treat a hydrocarbon stream making reference to generic hydrocarbon compositions and a generic solid catalyst, even though the zeolite ZSM-5 is mentioned, without being anyhow limited to the Si/Al ratio as in the present case. There is simply nothing in the art that suggests to the problem underlying the present invention, only hydrodealkylation of hydrocarbon compositions comprising alkylaromatic compounds C8-13. The disclosure that is relied upon in the rejection is only

“general guidance” (Bayer Schering Pharma AG v. Barr Laboratories, Inc., Id.) and simply is not the “finite disclosure” and guidance to “a particular solution” that the law requires.

(Bayer Schering Pharma AG v. Barr Laboratories, Inc., Id.)

Column 9, lines 5-27 is cited in support of the rejection. In this portion of Drake, the charge is a hydrocarbon mixture consisting of paraffins, olefins, naphthenes and aromatic compounds: its conversion is effected with the specific objective to obtain a reaction effluent richer in olefins and in C6-C8 aromatic hydrocarbons, in particular much richer than the olefins (preferably ethylene and propylene) which must be, by quantity and by weight, higher than the C6-C8 aromatic fraction (see Table 2, column 13).

Referring to the “achievement of olefins” the process provides the use of a gaseous “diluent” for the charge. Among the diluents, hydrogen is mentioned, but the preferred diluents are nitrogen and carbon dioxide. It is worthwhile to notice the ambiguousness of the terms used. In the art, the objective of adding a diluent to favor fluidodynamics, the mixing/homogenization/dispersion of the charge to improve the gaseous contact with the catalyst and, at the same time, conveying the heat developed in the reaction. To comply with these requirements the diluent must necessarily be inert with respect to the reaction. Drake is ambiguous as he gives the hydrogen the same role of inert diluent as if it were like the preferred nitrogen and anhydride dioxide. However, the high (and desired) presence of olefins in the reaction effluent is not at all compatible with the presence of hydrogen which, through a catalytic system, certainly affects the quantity of olefins present in the charge, even increasing its contents in the reaction effluent. It is in fact noticeably known that under Drake’s conditions the saturation of all, or the most of the double-links is obtained.

Column 10, lines 15-43 is also cited in support of the rejection. The reaction effluent can be formed of four fractions:

- a light fraction, comprising hydrogen and methane;

- a C2-C3 fraction, containing ethylene, propylene, ethane and propane;
- an intermediate fraction C4-C5;
- an aromatic fraction BTX.

This composition, typical in a reaction of **catalytic cracking**, is not at all pertinent to the reaction of a catalytic hydrodealkylation. Drake does not explicitly cite it as he clearly does not consider it (and he can not do it) as an integral part of the Drake process. In catalytic hydrodealkylation, the main objective is to improve the formation of benzene and toluene from aromatic and polyalkylated compounds; the alkyl substituents originally present in the polyalkylated aromatic compounds are “detached” from the aromatic ring. During this phase, as well known in the field, the outgoing alkyl groups cannot give olefins as they are quickly converted into correspondent paraffins (methane, ethane, etc) due to the jointed action of hydrogen and the catalyst.

Moreover, even when Drake discusses the possibility to successively process the aromatic fraction BTX present into the effluent with the objective to increase the concentration of some aromatic compounds with respect to others, Drake makes no reference to a hydrodealkylation process but rather to a “**hydrocarbon conversion**”.

“**Hydrocarbon conversion**” is, as so stated by Drake, an isomerization and/or transalkylation and/or disproportioning reaction, which reactions cause internal conversions among the aromatic hydrocarbons in the absence of hydrogen.

Column 8, lines 57-59 is also cited in the rejection, which states:

The composition of the invention then can be, if desired, pretreated with a reducing agent before being used in a transalkylation or hydrodealkylation process for converting a hydrocarbon to an olefin and an aromatic hydrocarbon.

The term “hydrodealkylation,” according to Drake, is mentioned only one time (namely on column 8, line 59) and only to state that the catalyst could be also used, if desired,

in a "hydrodealkylation process". To this "quick reference" made by Drake it is improper to find, in this simple mention, a reaction or even a process which does not exist nor does Drake give any reasonable direction to only hydrodealkylation of hydrocarbons comprising alkylaromatic compounds.

Even here in col. 8, Drake specifically makes reference to a reaction of catalytic cracking with the objective to convert hydrocarbons into olefinic and aromatic compounds.

Column 3, lines 5-15 and Column 8, lines 10-56 are also cited in support of the rejection. Referring to lines 5-15 on column 3 and lines 10-56 column 8, Drake suggests the preparation of a certain catalyst shall be necessarily correspondent from an exclusively practical point of view. However, Drake's generalized teachings for the preparation of a catalyst are insufficient. It is very well-known in the art how even small modifications of composition may change the course of a reaction and, in part, the preparation procedure, of a catalyst. Catalysis is a complicated science one would not simply proceed at random without specific guidance as to what to do or what to achieve and cannot give any reasonably expected result.

Column 5, lines 29-34 is also cited in support of the rejection as it relates to molybdenum compounds. Referring to the catalyst, among the promoters indicated, the molybdenum appears only as a citation in column 9, line 29, in the same way as many other metals (B, Sn, Zr, Ge, In, La, Cr, Na, K and W). Like these metals, molybdenum is not used in the Examples. Indeed, according to Drake for the catalysts of interest, Drake prefers zinc titanate, magnesium silicate, zinc silicate, triethylphosphate and combinations thereof (see Claim 17). While Applicants understand that a prior art disclosure is not limited to its preferred embodiments, it is again stressed that this general disclosure does not lead to the particular solution that the present invention provides.

As stated by the present application, under the operating conditions and with the composition of the catalyst of the present invention, it has been surprisingly found that the hydrodealkylation reaction is not only quantitatively selective towards the formation of benzene and toluene, but that the benzene/toluene ratio is always distinctly favorable with respect to benzene. See also, pages 2-3 and the Examples, e.g., on pages 18-19 of the present specification.

Moreover, it is not clear the reason why the Examiner has associated molybdenum to the Tables I and II: Table I provides composition results of the reaction effluent, while in Table II it is outlined the yields obtained through the catalysts that are explicitly set forth in the claims. Molybdenum or one of its derivatives is not shown in the Tables whatsoever.

In conclusion, there is no guidance or disclosure in Drake for the process as claimed. Applicants respectfully submit that Applicants respectfully submit that the Examiner has not satisfied the Office's initial burden to establish that the claims of this application are unpatentable under 35 U.S.C. §103(a). The Examiner appears to have erred in interpreting the scope and content of Applicants' claims, erred in determining the scope and content of the prior art teaching, erred in ascertaining the differences between the prior art and the claimed invention, and based on the accumulated error, erred in concluding that the subject matter Applicants claim is unpatentable under 35 U.S.C. §103(a) for obviousness at the time the invention was made to a person having ordinary skill in the art in view of Drake's disclosure.

Again the claimed reaction is a catalytic hydrodealkylation wherein the hydrogen is a reactant (see also H₂/charge molar ratio), and not a diluent as taught by Drake, which hydrogen reactant facilitates selective dealkylation of the various alkylaromatic compounds (among which the xylenes) fed to benzene, toluene and ethane (BTE). Moreover, under our process conditions, the xylenes, as desired, are exclusively dealkylated and not isomerized

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and/or disproportioned and/or transalkylated. See also, pages 2-3 and the Examples, e.g., on pages 18-19 of the present specification.

For the reasons stated in this amendment and reply to the Office Action, Applicants respectfully request that the Examiner withdraw the rejection, indicate the allowability of all the claims pending in this application, and pass this case to issue.

Respectfully submitted,

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